MODIS Cloud Product

Product Description

The MODIS Cloud Product (MOD 06) combines infrared and visible techniques to determine both physical and radiative cloud properties. Daily global Level 2 (MOD06) and daily, 8-day and monthly Level 3 products (MOD08) are provided. Cloud particle phase (ice vs. water, clouds vs. snow), effective cloud particle radius, and cloud optical thickness are derived using the MODIS visible and near-infrared channel radiances. An indication of cloud shadows affecting the scene is also provided. Cloud top temperature, height, effective emissivity, phase (ice vs. water, opaque vs. non-opaque), and cloud fraction are produced by the infrared retrieval methods both day and night at 5×5 1-km pixel resolution.

Research & Applications

A thorough description of global cloudiness and its associated properties is essential to the MODIS mission for two reasons. First, clouds play a critical role in the radiative balance of the Earth, and must be accurately described in order to accurately assess climate and potential climate change. In addition, the presence or absence of cloudiness must be accurately determined in order to properly retrieve many atmospheric and surface parameters. For many of these retrievals, cloud cover, even thin cirrus, represents contamination. Key radiative properties of clouds such as phase, optical depth, and temperature may be retrieved using MODIS instruments with unprecedented resolution.

Data Set Evolution

The determination of cloud top properties will require the use of MODIS bands 29 and 31-36, along with the cloud mask product (MOD 35), to screen for clouds. In addition, NCEP or DAO global model analyses of surface temperature and pressure, profiles of temperature and moisture, and blended SST analyses will be required in the calculation of cloud forcing as a function of atmospheric pressure and emissivity. The Menzel cloud phase algorithm will require MODIS bands 29, 31, and 32 and analyses of surface emissivity.

The validation of cloud top heights will be conducted through comparisons with stereo determinations of cloud heights from GOES and lidar estimates and aircraft observations of cirrus heights. Cloud emissivity will be compared to lidar determined values. These interim products will be used in concert with field campaigns with the MAS instrument. The Menzel cloud phase parameter will be validated using HIRS/AVHRR data and by comparison to the King cloud phase parameter.

The King cloud phase algorithm requires product MOD 02, calibrated multispectral radiances. Cloud particle size and optical depth require these radiances plus the cloud top parameters within MOD 06 and

MOD 06, MOD 08
PRODUCT SUMMARY

Coverage:

global

Spatial/Temporal Characteristics:

varies with parameter; once or twice per day, at resolutions of 1 km or 5 km (Level 2) and 0.5° latitude and longitude, equal area and equal angle (Level 3)/ daily, 8-day, and monthly

Key Science Applications:

cloud parameterization, climate modeling, climate monitoring, increasing accuracy of other MODIS retrievals

Key Geophysical Parameters:

cloud particle phase (two algorithms), cloud particle size and optical depth, and cloud top temperature, emissivity and height

Processing Level:

2, 3

Product Type:

standard, at-launch

Science Team Contact:

P. Menzel, M. King

MODIS Cloud Product

the Menzel cloud phase parameter. In addition, these parameters require MODIS product MOD 09 (surface reflectance) and the NCEP analyses and profiles described above. The validation and quality control of these products will be performed primarily through the use of *in situ* measurements obtained during field campaigns and with the use of the MAS instrument.

Suggested Reading

King, M.D., *et al.*, 1992.

King, M.D., *et al*., 1996.

Nakajima, T.Y. and T. Nakajima, 1994.

Platnick, S., *et al*., 1996.

Strabala, K.I., *et al.*, 1994.

Wylie, D.P., *et al.*, 1994.

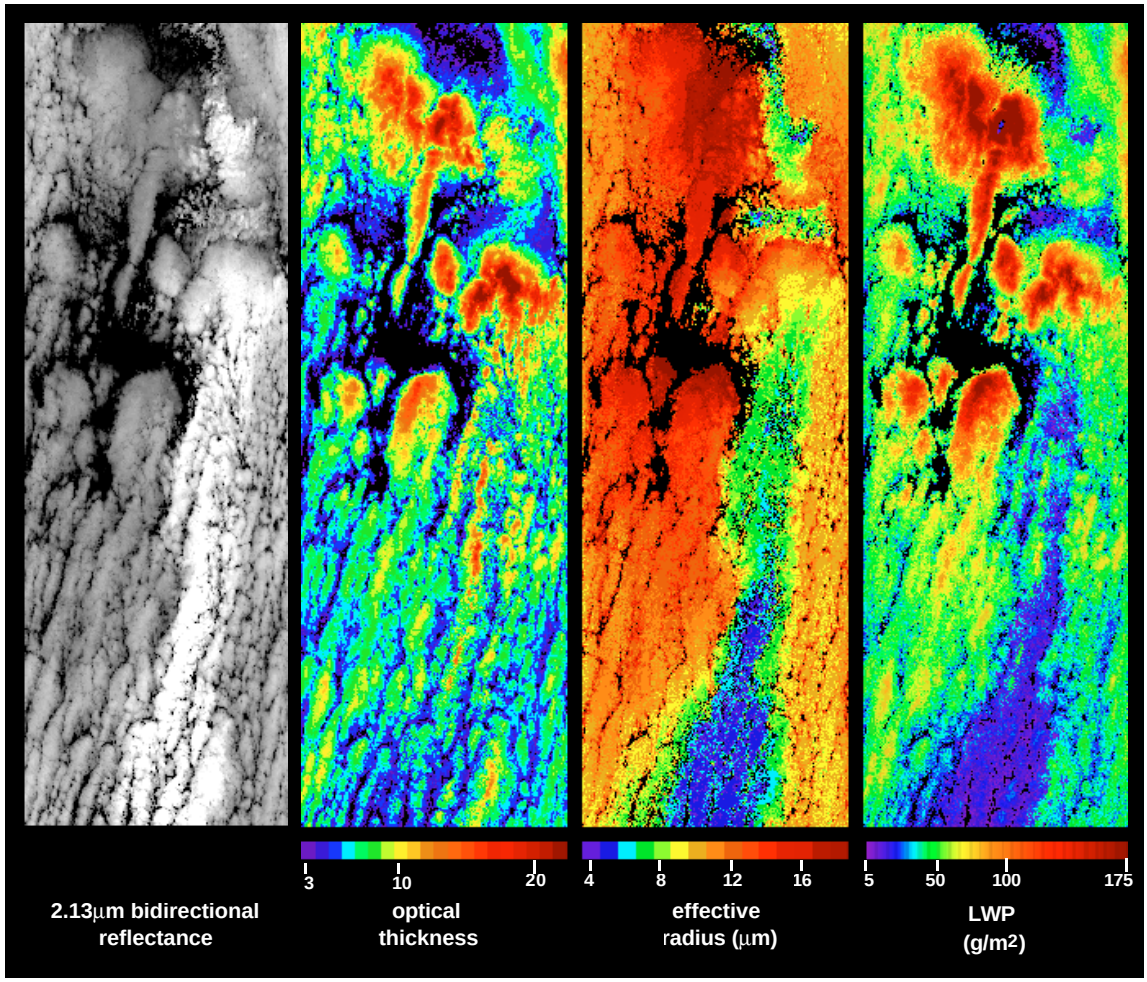

Figure 18. **Cloud Optical Thickness and Effective Radius**. MODIS Airborne Simulator 2.13 μm bidirectional reflectance along with retrieved cloud optical thickness, effective radius, and liquid water path (using MAS visible and 2.13 μm channels) for the southern portion of a ship track imaged off the coast of California on 29 June 1994. The ship is easily seen as the bright region in the reflectance panel and as the lower droplet size in the effective radius panel; the track is not obvious in the optical thickness panel. The last panel is liquid water path which is approximated as being proportional to the product of optical thickness and effective radius.

MODIS Cloud Product

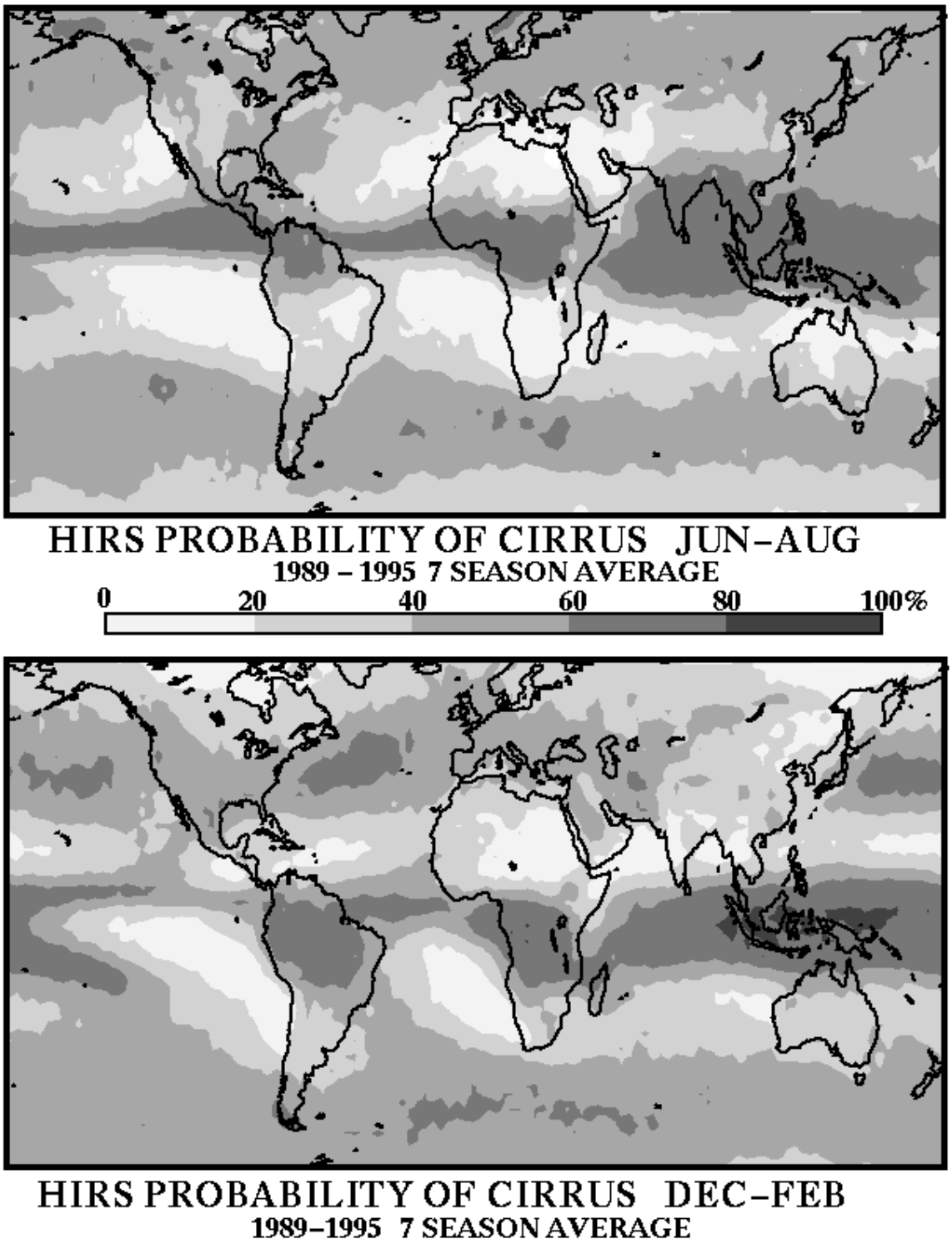

Figure 19. **HIRS Probability of cirrus**. Level 3 MODIS cloud product using a combination of the effective emissivity and cloud top pressure product to determine a geographical distribution of cirrus cloud. HIRS observations were used to generate this example. Top figure is for June-August, and the bottom figure December-February. Both panels represent 7 year averages.